SGA-1002
SGB-1003

SECTION

PROGRAMMED TEST SOURCES, inc.

Littleton, Massachusetts

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INTRODUCTION

The SGA-1002 and SGB-1003 are standard generators used in PTS synthesizers. They operate together from a crystal-oscillator input and, by direct arithmetic operations, produce common supply frequencies. These standard frequencies are distributed in the deck and used by most other modules in the synthesizer.

The SGA module can operate from either 5 or 10 MHz, and with this input it produces: discrete frequencies of 18, 20, 22 and 33 MHz on separate outputs; further all harmonics of 10MHz from 10 to 140 MHz with equal amplitude on one output. These frequencies are used by the SGB, DMs, DMA and SO modules in the synthesis process.

The SGB receives the 10 to 140 MHz *picket fence* from the SGA module and produces 14 and 16 MHz, 112 and 113 MHz, all on separate outputs. These frequencies are used by the DMs and DMA modules.

The SGA and SGB modules use DC power at +5.4V and -12.4V; since the outputs are constant and not subject to selection or control, no programming inputs are provided. These modules combine analog, VHF and digital techniques. All inputs and outputs are fed through card-edge connectors with multiple grounds provided for the RF signals.

These modules are unique; they are not interchangeable with any other module in the synthesizer. Both units are of plug-in design using three 10-pin connectors with asymmetric spacing, which assure proper orientation.

They are secured with three 6-32 pan-head screws from the bottom of the deck. Housed in a frame and U-cover enclosure, the SGA-1002 and SGB-1003 can be removed after releasing the three 6-32 screws.

To gain access to the PC boards, 4-40 top screws and 2-56 side screws have to be removed from the module U-cover. Printed circuit boards cannot be removed without first removing the modules from the deck.

PRINCIPLES OF OPERATION

The SGA-1002 and SGB-1003, standard generators which operate together, are depicted in the block diagram of Figure 1.

An input of 5 or 10 MHz and a level of 0.4V is received from an external or internal frequency standard and fed to the input amplifier/multiplier. This block is followed by a narrow crystal filter. The pulse generator receives its input from this crystal filter and produces a spectrum, which is the basis for *all* fixed or standard frequencies in the synthesizer. Of these, the five low frequencies of 14, 16, 18, 20 and 22 MHz are all produced by division of a specific spectrum-line through an amplifier-filter circuit, a digital divider, and a filter at the output frequency. The two higher standard frequencies of 112 and 113 MHz also use one specific spectrum line each. Mixers (M) add derivatives of certain low standard frequencies, as shown, to obtain the final frequencies. Thus, by multiplication, division and addition, the SGA and SGB produce seven standard frequencies which are completely coherent with the input frequency of 5 or 10 MHz.

According to Schematic 1002-S (Figure 2), the 5/10 MHz input signal drives Q7, which amplifies or multiplies, and a 10 MHz single-pole crystal filter Y1 follows, which removes noise (and attenuates 5 MHz). The resulting 10 MHz signal can be used externally (to drive slave instruments) from the output of emitter-follower Q6. It is applied internally to pulse generator Q5/Q4.

At the output of the pulse generator (R23/R24) a spectrum of n x 10 MHz multiples from 10 to 140 MHz is available. These frequencies are the source of all standard frequencies in the instrument. Three of the lower frequencies are produced in the SGA.

Since the three sections are identical, a description of one – the 20 MHz generator – shall suffice to illustrate the process. Loosely coupled to the *spectrum bus* by C16, transistor Q3 amplifies the 100 MHz line, and this signal, after filtering in L16, C17, C18, reaches the divider U3. The divide-by-five section of U3 is used, and a 20 MHz signal from pin 4 is connected to a tuned circuit. A low impedance output, taken across C35 is fed to pin 43 and then to the 20 MHz bus in the deck.

A frequency of 33 MHz is needed to produce 113 MHz in the SGB module. This signal is produced by U1, where the 22 MHz output is divided by 2 and the third harmonic, after filtering, is fed to pin 2 and then to the SGB module.

As shown on Schematic 1003-S (Figure 3), the SGB receives the 10 to 140 MHz spectrum from the SGA module on pin 20. The schematic shows, starting from the middle, on the left-hand side the generation of 14 MHz and 112 MHz signals, and in the right half the generation of 16 MHz and 113 MHz. The low frequencies are produced by the same divide-by-five process which is used in the SGA module: The 70 MHz line is pre-filtered, amplified and filtered in L4, C13, C14, from where it enters divider U1; the resulting 14 MHz signal, after filtering, reaches pin 10, the output.

The same IC also supplies a third harmonic of 14 MHz to Q3. After amplification this 42 MHz signal serves as injection to Q1, which is the final mixer producing 112 MHz by adding a 70 MHz input from Q2.

The 16 MHz generation is identical to the 14 MHz circuits, and 80 MHz is filtered and amplified further to drive mixer Q7 on the 113 MHz side. The 33 MHz signal, coming from the SGA, is amplified in Q8 and then fed to the mixer. Double-tuned filters are employed on both sides to filter the 112 and 113 MHz mixer outputs.

SERVICE

Maintenance

No preventive maintenance is required for the SGA or SGB modules. The presence of standard output signals of correct frequency and level indicates that the modules are operating properly.

All outputs of the SGA and SGB modules, with the exception of the 112 and 113 MHz signals, are produced directly by IC digital dividers. A 10 dB window exists at the divider inputs and minor aging effects will, therefore, not impair operation.

Replacement of faulty components requires careful use of PC repair techniques as applicable to double-sided boards with plated-through holes.

Alignment

Complete alignment of this module is made at the factory with a special test set. Restoring the alignment after replacement of individual parts in the field is possible. It is recommended that voltages given in the Troubleshooting procedure be used, and that in general touch-up alignment be performed only on those tuned circuits which may have been altered by the parts replacements. Replacement of semiconductors will not generally necessitate realignment of tuned circuits.

Troubleshooting

The System Section of this manual provides information necessary to isolate faulty modules. It is important to follow the procedure step by step to ensure proper identification of failure before attempting to repair modules.

If an SGA or SGB module has been isolated as faulty, the preferred service mode is exchange and factory repair. When immediate service is needed, the following procedure may be used.

Test Equipment Required:

RF Voltmeter	1 - 300 MHz, 10 mV - 1V, High Impedance Probe (3 pF, DC Res. 100 KΩ)
HF Counter	0 - 200 MHz, 10 mV Sensitivity, High Impedance or 50 Ω Input
Spectrum Analyzer	10 - 600 MHz, 50 Ω Input, 60 dB min Dynamic Range, Resolution 1 MHz

System Section troubleshooting isolates failure in the SGA and SGB to specific outputs. In addition, the block diagram (Figure 1) and schematics (Figure 2 and 3) are structured such that individual circuit-sections are recognizable, and this will aid in the search for the failure.

DC checks of suspected active devices are the proper first step. Voltage drops across the emitter-resistors of the transistors are all 1.2 - 1.5V, except in the SGA across R36 and R25, where 1.9 - 2.3V are normal (R25 with RF drive).

Basic to all output signals is the presence of the *picket fence* of 10 - 140 MHz. The spectrum analyzer connected in place of the SO module (J1) must show each frequency with a level of -16 to -19 dBm. Instruments *not* using an SO module will have a termination on pin 45 (SGA); the S/A connected in place of the termination will show -8 to -11 dBm of spectrum signals.

Note: Avoid S/A signal overloads.

The active devices in the pulse generation are Q7, Q5, Q4. Crystal-filter Y1 output is 0.4 - 0.5V across R31.

If the picket fence is normal, low level or absence of a specific frequency may be traced as follows: Connect the S/A to the output in question. Total absence of output in a 14 to 22 MHz frequency generally indicates that the divider is not triggered. All injection voltages, which are connected to pin 7 of the IC (MC-10138), are accessible to the voltmeter probe from the component side of the

board. A minimum level of 0.3V is required there. The input and output trimmer capacitors may be identified and retuned (e.g., the trimmers for the 90 MHz circuits feeding the 18 MHz divider are C10 and C12).

If a specific low frequency (14 to 22 MHz) is displayed on the S/A, but the level is low, output circuits are defective or detuned. Every output circuit is tuned by a single trimmer (e.g., C42 tunes the 18 MHz output).

The 112 and 113 MHz outputs are the result of mixing two frequencies. In both cases the first step in tracing trouble is checking the 14 or 16 MHz outputs as detailed before. If these low frequencies are present, connect the S/A to the faulty output (112 or 113 MHz) and attempt to tune: C9, C19, C4, C1 for the 112 MHz output and C46, C53, C56, C60 for the 113 MHz output. At the bases of Q1 and Q7, 0.4V min should be obtained; this is a composite of both injections. This level and its variation with tuning both injections will locate the fault in either one of the mixer inputs or the output circuits following the mixer.

SGA-1002 PARTS LIST

Schem. Desig.	Description	PTS P/N
	CAPACITORS	
C1	10 nF, 80/20%, 50V, Z5V	23-0103
C2	22 pF, 5%, 500V, NPO	20-0220
C3	3-13 pF, Trimmer	26-5101
C4	1.0 pF, .25 pF, 500V, NPO	24-1100
C5	1-10 pF, Trimmer	26-5100
C6	27 pF, 5%, 500V, NPO	20-0270
C7	10 nF, 80/20%, 50V, Z5V	23-0103
C8	10 nF, 80/20%, 50V, Z5V	23-0103
C9	22 pF, 5%, 500V, NPO	20-0220
C10	3-13 pF, Trimmer	26-5101
C11	1.0 pF, .25 pF, 500V, NPO	24-1100
C12	1-10 pF, Trimmer	26-5100
C13	47 pF, 5%, 500V, NPO	20-047
C14	10 nF, 80/20%, 50V, Z5V	23-0103
C15	22 pF, 5%, 500V, NPO	20-0220
C16	1.0 pF, .25 pF, 500V, NPO	24-1100
C17	1-10 pF, Trimmer	26-5100
C18	33 pF, 5%, 500V, NPO	20-0330
C19	3-13 pF, Trimmer	26-5101
C20	10 nF, 80/20%, 50V, Z5V	23-0103
C21	3-13 pF, Trimmer	26-5101
C22	10 nF, 80/20%, 50V, Z5V	23-0103
C23	10 nF, 80/20%, 50V, Z5V	23-0103
C24	100 pF, 10%, 500V, X5F	22-0101
C25	110 pF, 5%, MICA	27-5100
C26	1-10 pF, Trimmer	26-5100
C27	6.8 μF, El.,Tant., 16V	30-5101
C28	10 nF, 80/20%, 50V, Z5V	23-0103
C29	33 pF, 5%, 500V, NPO	20-0330
C30	120 pF, 10%, 500V, X5F	22-0121
C31	3-13 pF, Trimmer	26-5101
C32	10 nF, 80/20%, 50V, Z5V	23-0103
C33	10 nF, 80/20%, 50V, Z5V	23-0103
C34	10 nF, 80/20%, 50V, Z5V	23-0103
C35	1 nF, 10%, 500V, X5F	22-0102
C36	3-13 pF, Trimmer	26-5101
C37	50 nF, 80/20%, 50V, Z5V	23-0503
C38	50 nF, 80/20%, 50V, Z5V	23-0503
C39	50 nF, 80/20%, 50V, Z5V	23-0503
C40	5 pF, .25 pF, 500V, NPO	20-1500
C41	1 nF, 10%, 500V, X5F	22-0102
C42	3-13 pF, Trimmer	26-5101
C43	5 pF, .25 pF, 500V, NPO	20-1500
C44	50 nF, 80/20%, 50V, Z5V	23-0503
C45	1 nF, 10%, 500V, X5F	22-0102

SGA-1002 PARTS LIST (continued)

Schem. Desig.	Description	PTS P/N
	CAPACITORS (continued)	
C46	3-13 pF, Trimmer	26-5101
C47	5 pF, .25 pF, 500V, NPO	20-1500
C48	5 pF, .25 pF, 500V, NPO	20-1500
C49	3-13 pF, Trimmer	26-5101
C50	10 pF, 5%, 500V, NPO	20-0100
C51	560 pF, 10%, 500V, X5F	22-0561
C52	50 nF, 80/20%, 50V, Z5V	23-0503
C53	10 nF, 80/20%, 50V, Z5V	23-0103
C54	10 nF, 80/20%, 50V, Z5V	23-0103
C55	5 pF, .25 pF, 500V, NPO	20-1500
	INDUCTORS	
L1	0.33 μH, 10%	36-5104
L2	0.33 μH, 10%	36-5104
L3	0.33 μH, 10%	36-5104
L4	0.20 μH, nom.	35-5101
L5	2.2 μH, 10%	36-5103
L6	1.0 μH, 10%	36-5105
L7	22 μH, 10%	36-5106
L8	5.6 μH, 10%	36-5100
L9	22 μH, 10%	36-5106
L10	5.6 μH, 10%	36-5100
L11	22 μH, 10%	36-5106
L12	5.6 μH, 10%	36-5100
L13	5.6 μH, 10%	36-5100
L14	50 nH, nom.	35-5106
L15	50 nH, nom.	35-5106
L16	50 nH, nom.	35-5106
	RESISTORS	
R1	6.8 KΩ, 5%, ¼W	10-0682
R2	330 Ω, 5%, ¼W	10-0331
R3	1.5 KΩ, 5%, ¼W	10-0152
R4	6.8 KΩ, 5%, ¼W	10-0682
R5	330 Ω, 5%, ¼W	10-0331
R6	1.5 KΩ, 5%, ¼W	10-0152
R7	6.8 KΩ, 5%, ¼W	10-0682
R8	330 Ω, 5%, ¼W	10-0331
R9	1.5 KΩ, 5%, ¼W	10-0152
R10	2.2 KΩ, 5%, ¼W	11-0222
R11	220 Ω, 5%, ¼W	10-0221
R12	220 Ω, 5%, ¼W	10-0221
R13	220 Ω, 5%, ¼W	10-0221
R14	680 Ω, 5%, ¼W	11-0681
R15	2.2 KΩ, 5%, ¼W	11-0222
R16	680 Ω, 5%, ¼W	11-0681

Note: 10-XXXX carbon composition
11-XXXX carbon film

SGA-1002 PARTS LIST (continued)

Schem. Desig.	Description	PTS P/N
	RESISTORS (continued)	
R17	220 Ω, 5%, ¼W	10-0221
R18	680 Ω, 5%, ¼W	11-0681
R19	2.2 KΩ, 5%, ¼W	11-0222
R20	15 Ω, 5%, ¼W	10-0150
R21	220 Ω, 5%, ¼W	10-0221
R22	15 Ω, 5%, ¼W	10-0150
R23	100 Ω, 5%, ¼W	10-0101
R24	15 Ω, 5%, ¼W	10-0150
R25	1 KΩ, 5%, ¼W	10-0102
R26	1 KΩ, 5%, ¼W	10-0102
R27	4.7 KΩ, 5%, ¼W	10-0472
R28	100 Ω, 5%, ¼W	10-0101
R29	680 Ω, 5%, ¼W	10-0681
R30	6.8 KΩ, 5%, ¼W	10-0682
R31	68 Ω, 5%, ¼W	10-0680
R32	47 Ω, 5%, ¼W	10-0470
R33	15 Ω, 5%, ¼W	10-0150
R34	1.5 KΩ, 5%, ¼W	10-0152
R35	2.2 KΩ, 5%, ¼W	10-0222
R36	100 Ω, 5%, ¼W	10-0101
R37	6.8 KΩ, 5%, ¼W	10-0682
R38	1.5 KΩ, 5%, ¼W	10-0152
R39	47 Ω, 5%, ¼W	10-0470
R40	330 Ω, 5%, ¼W	10-0331
R41	47 Ω, 5%, ¼W	10-0470
R42	100 Ω, 5%, ¼W	10-0101
R43	15 Ω, 5%, ¼W	10-0150
R44	15 Ω, 5%, ¼W	10-0150
	TRANSISTORS	
Q1	2N 5179	40-5179
Q2	2N 5179	40-5179
Q3	2N 5179	40-5179
Q4	2N 5179	40-5179
Q5	2N 3250	41-3250
Q6	2N 2369	40-2369
Q7	2N 2369	40-2369
	DIODES	
CR1	1N 4151	70-4151
	INTEGRATED CIRCUITS	
U1	MC10138	62-5100
U2	MC10138	62-5100
U3	MC10138	62-5100
Y1	Crystal, Filter (or Resistor)	85-5100 (10-0150)

SGB-1003 PARTS LIST

Schem. Desig.	Description	PTS P/N
	CAPACITORS	
C1	1-10 pF, Trimmer	26-5100
C2	33 pF, 5%, 500V, NPO	20-0330
C3	33 pF, 5%, 500V, NPO	20-0330
C4	1-10 pF, Trimmer	26-5100
C5	0.5 pF, .25 pF, 500V, NPO	24-2500
C6	22 pF, 5%, 500V, NPO	20-0220
C7	2.2 pF, 5%, 500V, NPO	20-1220
C8	56 pF, 5%, Mica	27-5101
C9	1-10 pF, Trimmer	26-5100
C10	10 nF, 80/20%, 50V, Z5V	23-0103
C11	10 pF, 5%, 500V, NPO	20-0100
C12	1.5 pF, .25 pF, 500V, NPO	24-1150
C13	47 pF, 5%, 500V, NPO	20-0470
C14	1-10 pF, Trimmer	26-5100
C15	10 nF, 80/20%, 50V, Z5V	23-0103
C16	3.3 pF, 5%, 500V, NPO	20-1330
C17	10 nF, 80/20%, 50V, Z5V	23-0103
C18	27 pF, 5%, 500V, NPO	20-0270
C19	3-13 pF, Trimmer	26-5101
C20	33 pF, 5%, 500V, NPO	20-0330
C21	10 nF, 80/20%, 50V, Z5V	23-0103
C22	15 pF, 5%, 500V, NPO	20-0150
C23	560 pF, 10%, 500V, X5F	22-0561
C24	12 pF, 5%, 500V, NPO	20-0120
C25	5 pF, .25 pF, 500V, NPO	20-1500
C26	3-13 pF, Trimmer	26-5101
C27	1.5 nF, 10%, 500V, X5F	22-0152
C28	50 nF, 80/20%, 50V, Z5V	23-0503
C29	10 nF, 80/20%, 50V, Z5V	23-0103
C30	6.8 pF, 5%, 500V, NPO	20-1680
C31	3-13 pF, Trimmer	26-5101
C32	1.5 pF, .25 pF, 500V, NPO	24-1150
C33	50 nF, 80/20%, 50V, Z5V	23-0503
C34	50 nF, 80/20%, 50V, Z5V	23-0503
C35	2.2 pF, 5%, 500V, NPO	20-1220
C36	3-13 pF, Trimmer	26-5101
C37	47 pF, 5%, 500V, NPO	20-0470
C38	22 pF, 5%, 500V, NPO	20-0220
C39	10 nF, 80/20%, 50V, Z5V	23-0103
C40	1-10 pF, Trimmer	26-5100
C41	33 pF, 5%, 500V, NPO	20-0330
C42	3.3 pF, 5%, 500V, NPO	20-1330
C43	10 pF, 5%, 500V, NPO	20-0100
C44	3.3 pF, 5%, 500V, NPO	20-1330
C45	10 nF, 80/20%, 50V, Z5V	23-0103

Schem. Desig.	Description	PTS P/N
	CAPACITORS (continued)	
C46	1-10 pF, Trimmer	26-5100
C47	47 pF, 5%, 500V, NPO	20-0470
C48	22 pF, 5%, 500V, NPO	20-0220
C49	3.3 pF, 5%, 500V, NPO	20-1330
C50	10 nF, 80/20%, 50V, Z5V	23-0103
C51	10 nF, 80/20%, 50V, Z5V	23-0103
C52	50 nF, 80/20%, 50V, Z5V	23-0503
C53	3-13 pF, Trimmer	26-5101
C54	47 pF, 5%, 500V, NPO	20-0470
C55	10 nF, 80/20%, 50V, Z5V	23-0103
C56	1-10 pF, Trimmer	26-5100
C57	33 pF, 5%, 500V, NPO	20-0330
C58	0.5 pF, .25 pF, 500V, NPO	24-2500
C59	33 pF, 5%, 500V, NPO	20-0330
C60	1-10 pF, Trimmer	26-5100
C61	27 pF, 5%, 500V, NPO	20-0270
C62	3-13 pF, Trimmer	26-5101
C63	12 pF, 5%, 500V, NPO	20-0120
C64	1.5 nF, 10%, 500V, X5F	22-0152
C65	1 nF, 10%, 500V, X5F	22-0102
C66	50 nF, 80/20%, 50V, Z5V	23-0503
	INDUCTORS	
L1	50 nH, nom.	35-5100
L2	50 nH, nom.	35-5100
L3	90 nH, nom.	35-5107
L4	90 nH, nom.	35-5107
L5	90 nH, nom.	35-5107
L6	90 nH, nom.	35-5107
L7	50 nH, nom.	35-5100
L8	50 nH, nom.	35-5100
L9	.33 μH, 10%	36-5104
L10	5.6 μH, 10%	36-5100
L11	.33 μH, 10%	36-5104
L12	.33 μH, 10%	36-5104
L13	5.6 μH, 10%	36-5100
L14	22 μH, 5%	36-5106
L15	22 μH, 5%	36-5106
L16	.33 μH, 10%	36-5104
L17	1.0 μH, 5%	36-5105
	RESISTORS	
R1	150 Ω, 5%, ¼W	10-0151
R2	1.5 KΩ, 5%, ¼W	10-0152
R3	6.8 KΩ, 5%, ¼W	10-0682
R4	330 Ω, 5%, ¼W	10-0331
R5	1.5 KΩ, 5%, ¼W	10-0152
R6	6.8 KΩ, 5%, ¼W	10-0682

Note: 10-XXXX carbon composition
11-XXXX carbon film

SGB-1003 PARTS LIST (continued)

Schem. Desig.	Description	PTS P/N
	RESISTORS (continued)	
R7	6.8 KΩ, 5%, ¼W	10-0682
R8	470 Ω, 5%, ¼W	10-0471
R9	680 Ω, 5%, ¼W	11-0681
R10	2.2 KΩ, 5%, ¼W	11-0222
R11	1.5 KΩ, 5%, ¼W	10-0152
R12	680 Ω, 5%, ¼W	10-0681
R13	15 Ω, 5%, ¼W	10-0150
R14	220 Ω, 5%, ¼W	10-0221
R15	220 Ω, 5%, ¼W	10-0221
R16	1.5 KΩ, 5%, ¼W	10-0152
R17	6.8 KΩ, 5%, ¼W	10-0682
R18	6.8 KΩ, 5%, ¼W	10-0682
R19	1.5 KΩ, 5%, ¼W	10-0152
R20	220 Ω, 5%, ¼W	10-0221
R21	2.2 KΩ, 5%, ¼W	11-0222
R22	680 Ω, 5%, ¼W	11-0681
R23	220 Ω, 5%, ¼W	10-0221
R24	150 Ω, 5%, ¼W	10-0151
R25	15 Ω, 5%, ¼W	10-0150
R26	680 Ω, 5%, ¼W	10-0681
R27	1.5 KΩ, 5%, ¼W	10-0152
R28	150 Ω, 5%, ¼W	10-0151
R29	1.5 KΩ, 5%, ¼W	10-0152
R30	6.8 KΩ, 5%, ¼W	10-0682
R31	220 Ω, 5%, ¼W	10-0221
R32	1.5 KΩ, 5%, ¼W	10-0152
R33	6.8 KΩ, 5%, ¼W	10-0682
R34	6.8 KΩ, 5%, ¼W	10-0682
R35	15 Ω, 5%, ¼W	10-0150
R36	15 Ω, 5%, ¼W	10-0150
R37	15 Ω, 5%, ¼W	10-0150
R38	15 Ω, 5%, ¼W	10-0150
R39	15 Ω, 5%, ¼W	10-0150
R40	15 Ω, 5%, ¼W	10-0150
R41	15 Ω, 5%, ¼W	10-0150
	TRANSISTORS	
Q1	2N 5179	40-5179
Q2	2N 5179	40-5179
Q3	2N 5179	40-5179
Q4	2N 5179	40-5179
Q5	2N 5179	40-5179
Q6	2N 5179	40-5179
Q7	2N 5179	40-5179
Q8	2N 5179	40-5179
	INTEGRATED CIRCUITS	
U1	MC10138	62-5100
U2	MC10138	62-5100

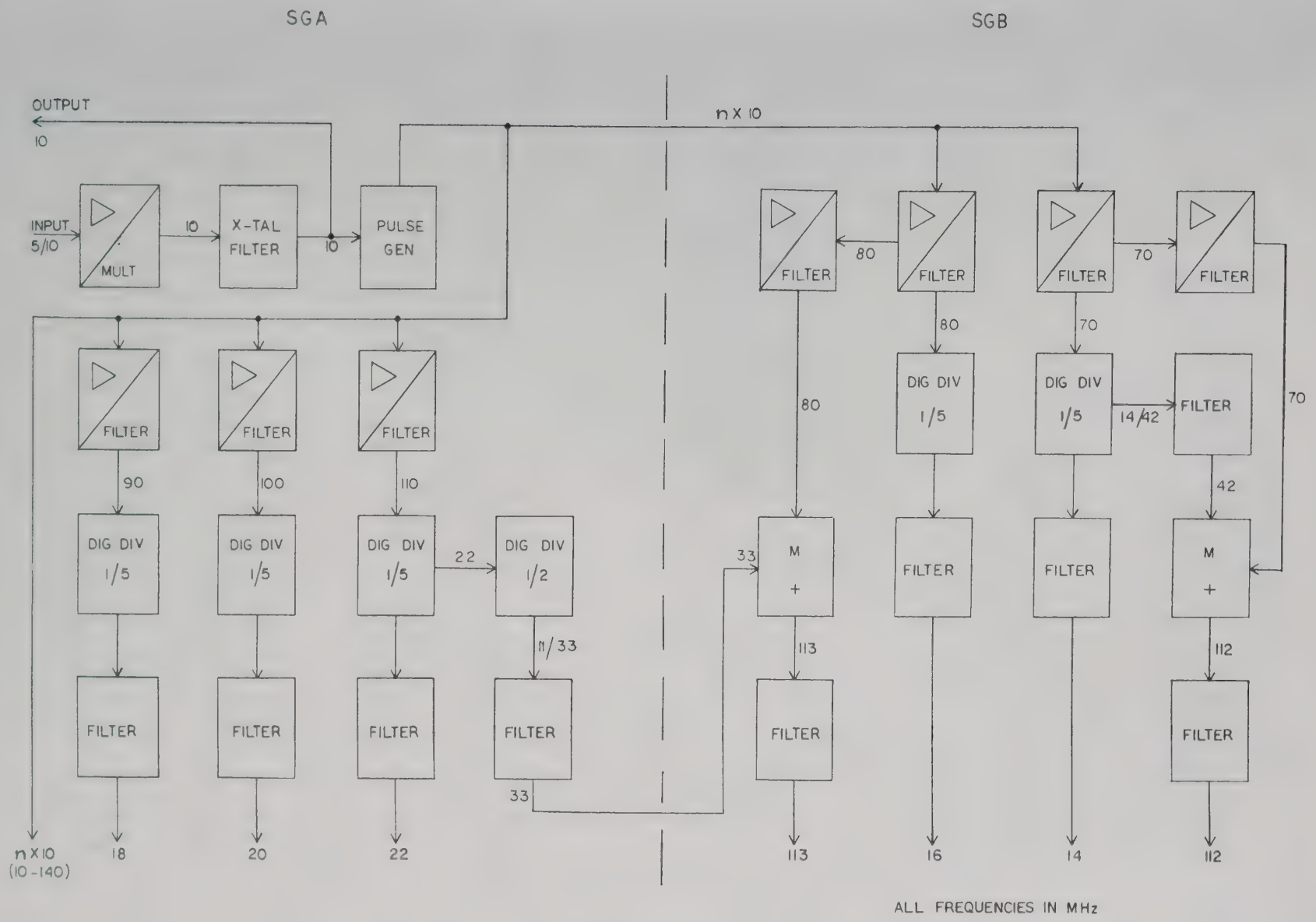

SGA
SGB
OUTPUT
10
n X 10
INPUT
5/10
MULT
10
X-TAL
FILTER
10
PULSE
GEN
FILTER
80
FILTER
FILTER
70
FILTER
80
70
80
DIG DIV
1/5
DIG DIV
1/5
14/42
FILTER
70
90
100
110
42
DIG DIV
1/5
DIG DIV
1/5
DIG DIV
1/5
22
DIG DIV
1/2
33
M
+
FILTER
FILTER
M
+
n/33
113
112
FILTER
FILTER
FILTER
FILTER
FILTER
FILTER
FILTER
33
n X 10
(10 - 140)
18
20
22
113
16
14
112
ALL FREQUENCIES IN MHz

Figure 1

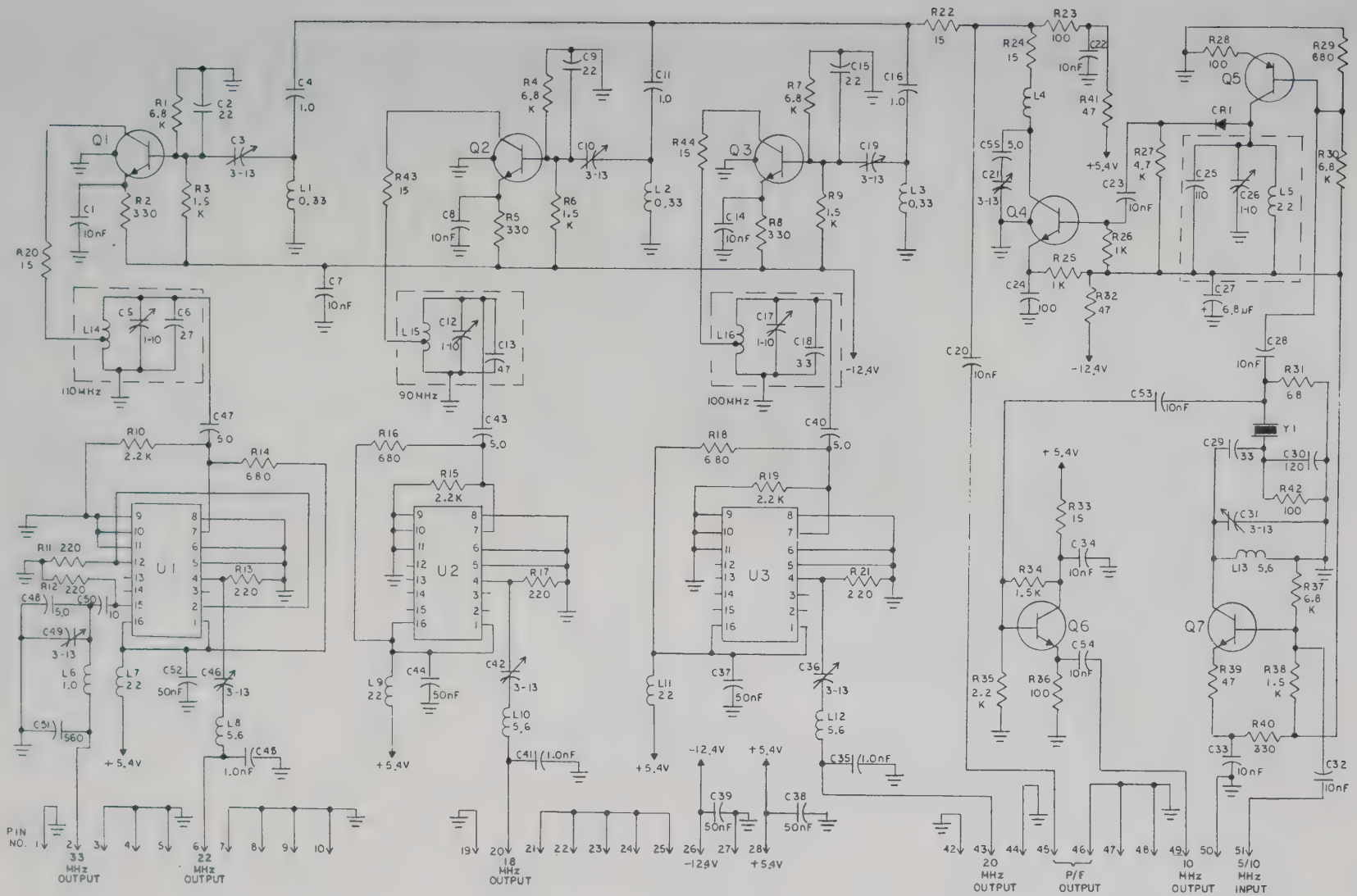

Q1
Q2
Q3
Q4
Q5
Q6
Q7
U1
U2
U3
CR1
Y1
110MHz
90MHz
100MHz
+5.4V
-12.4V
PIN NO. 1
33 MHz OUTPUT
22 MHz OUTPUT
18 MHz OUTPUT
20 MHz OUTPUT
P/F OUTPUT
10 MHz OUTPUT
5/10 MHz INPUT
SGA-1002

Figure 2

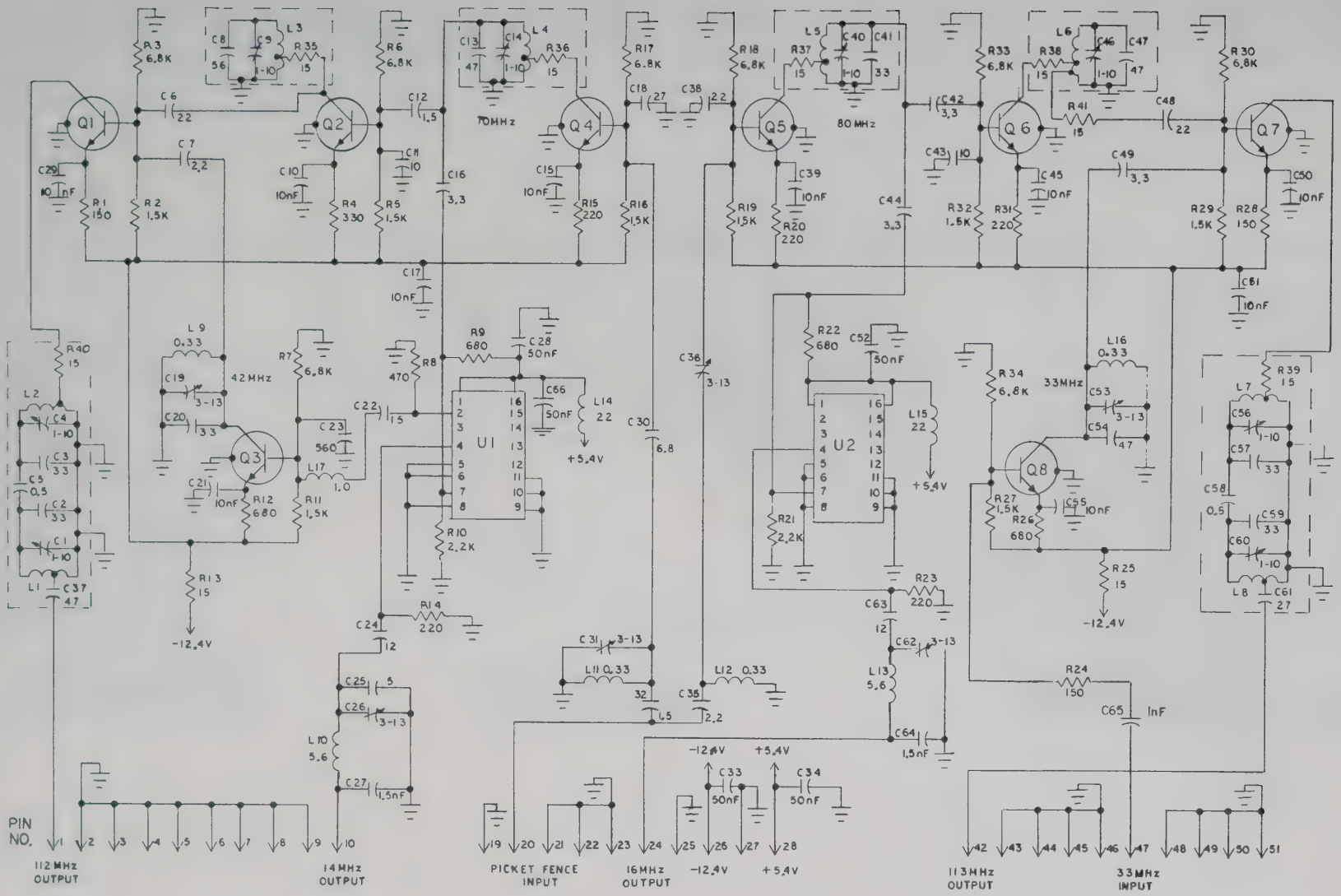
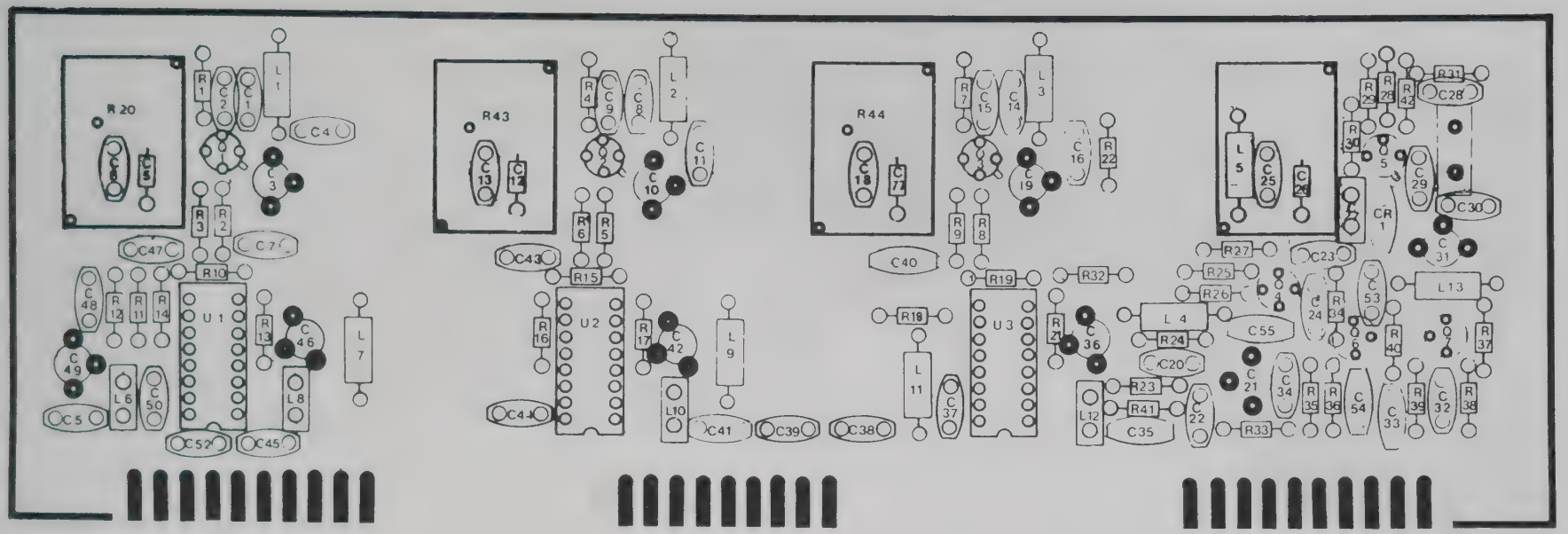


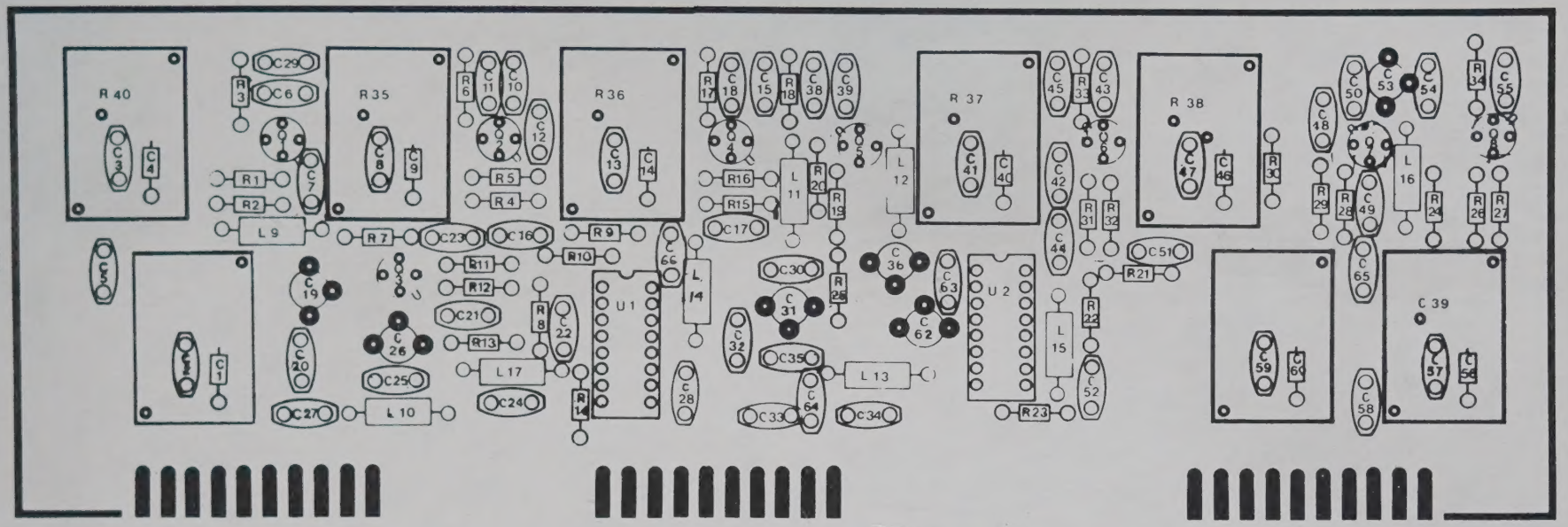
Figure 3

SGB-1003



SGA-1002

Figure 4



SGB-1003

Figure 5